Memory Mapping
From 24 bits to 32 bits
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While upgrading the IRM software from a 68040-based MVME-162 board to a PowerPC MVME-2400 board, we encountered a need to specify a 32-bit address within the 24 bits available in the analog control field of the analog descriptor. In the earlier version, there was very little need for 32-bit addresses except for those of the form FFF58xxx, which targeted registers on the IndustryPack boards. The simple rule of extending the sign for 24-bit addresses of the form Fxxxxx was enough, along with the rule that analog type numbers in the range 40—7F really meant that the type for memory word access should be used with that value in the hi byte of the address.

With the MVME-2400 board, however, there exists 32MB of dynamic memory on the board, which of course occupies addresses 00000000—01FFFFFF. The nonvolatile memory is to be placed at 48000000, and the Digital PMC (Technobox) board is to be placed at 49000000. This means that we have several variations of the upper byte of memory addresses to support. The scheme devised for handling this is a simple memory-mapping scheme, in which the hi 8 bits of the 24 bits is used as an index into a MAP32 system table of 256 possible 16-bit values. The 16 bits from the indicated table element is used as the upper 16 bits of the result address, the lower 16 bits of which is taken directly from the remaining 16 bits of the 24-bit address.

Another table that commonly needs memory addresses is the BADDR, or binary address table, in which each 4-byte entry is a memory address of a byte of memory that is to be accessed. Besides a few special cases of the hi byte having values of 80—83, the entries are raw 32-bit byte addresses. An entry in the data access table causes the BADDR table to be used as an array of byte addresses to derive each byte of binary data. One could assign another special hi byte value that could mean that the low 24 bits are to be mapped via the MAP32 table An advantage to this scheme is that one can change an entire range of actual addresses by modifying one or more entries in the MAP32 table.

There is a price to be paid for this scheme. The number of possible different values of the upper 32 bits of addresses is limited to the 256 entries available in the MAP32 table. Also, while this scheme could be used for analog control fields and for BADDR entries, there are also memory addresses that show up in Data Access Table fields and CINFO fields that must be monitored in the event of a change in an entire range of target addresses.